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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/010,850	12/05/2001	Peggy J. Clews	SD6957S97604	7432
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Sandia National Laboratories P. O. Box 5800 - MS-0161 Albuquerque, NM 87185-0161				
			EXAMINER TRAN, BINH X	
			ART UNIT 1765	PAPER NUMBER

DATE MAILED: 03/22/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/010,850

Applicant(s)

CLEWS ET AL.

Examiner

Binh X Tran

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 29 December 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1 and 4-9 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1, 4-9 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 112***

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claim 4 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 4, the "metal layer" lacks antecedent basis and indefinite. Applicants narrow the claim by defining the metal layer is aluminum in claim 1. Thus, Applicants cannot broaden the dependent claim by using the generic term "metal layer". The examiner suggests replacing "metal layer" with --aluminum layer--.

### ***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was

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not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 1, 4-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liaw et al. (US 6,605,230) in view of Smith et al. (US 6,479,395) and Gennissen ("Sacrificial Oxide Etching Compatible with Aluminum Metallization").

Liaw discloses a method for etching a semiconductor device using a plurality of deposited and patterned layers of polysilicon, oxide material comprising the step of:

etching the sidewall made of  $\text{SiO}_2$  (read on oxide sacrificial material) by immersing the device using an etching solution comprising hydrofluoric acid (HF) and sulfuric acid ( $\text{H}_2\text{SO}_4$ ) (Fig 1, col. 2-3). Liaw differs from the invention by the specific ratio between HF and  $\text{H}_2\text{SO}_4$ . However, Liaw clearly teaches the specific ratio between HF and  $\text{H}_2\text{SO}_4$  is a result effective variable (col. 2 lines 36-50).

In a method for etching glass (aka silicon oxide or silicon dioxide), Smith teaches to use a solution comprises hydrofluoric acid and a counter acid such as sulfuric acid (col. 7 lines 25-45). Smith further discloses the ratio between the hydrofluoric acid and counter acid (including sulfuric acid) is a result effective variable. In one specific example, Smith discloses the hydrofluoric acid amount ranges 25% to 1 % and counter acid amount ranges from 40% to 5 % (col. 7 lines 30-35). Since Smith clearly teaches the amount of hydrofluoric acid and counter acid ( $\text{H}_2\text{SO}_4$ ) is variable, any person having ordinary skill in the art would be able to choose any specific amount of hydrofluoric acid and counter acid within Smith's suggested range to have the acid ratio the same as

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applicants' invention. For example, if one chooses 25 % of HF and 8.33 % of counter acid, the ratio of HF:  $\text{H}_2\text{SO}_4$  (counter acid) would be 3:1. If 25% of HF and 25% of counter acid is used, the ratio of HF:  $\text{H}_2\text{SO}_4$  (counter acid) is 1:1. Further, the result effective variable is commonly determined by routine experiment. The process of conducting routine experiments so as to produce an expected result is obvious to one of ordinary skill in the art. Hence, it would have been obvious to one having ordinary skill in the art, at the time of invention, to perform routine experiment to obtain optimal ratio as an expected result.

Liaw and Smith fail to disclose the present of the aluminum layer in the semiconductor device. Gennissen teaches a semiconductor device having an aluminum layer. It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Liaw and Smith in view of Gennissen by using a aluminum layer because it can be used as an interconnect layer.

Respect to claim 4, Gennissen discloses the etch selectivity for the oxide sacrificial relative to aluminum range from 40 to 680 (within applicant range of greater than 100). Gennissen further discloses the selectivity is a result effective variable (Table 3). The result effective variable is commonly determined by routine experiment. The process of conducting routine experiments so as to produce an expected result is obvious to one of ordinary skill in the art. Hence, it would have been obvious to one having ordinary skill in the art, at the time of invention, to perform routine experiment to obtain optimal selectivity as an expected result.

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Respect to claim 5, Liaw discloses that the semiconductor device is used for integrated circuit (read on micro-mechanical and/or micro-electrical-mechanical device). Respect to claim 6, Liaw teaches to etch the SiO<sub>2</sub> material at 0-140 °C (col. 2 lines 57-59; within applicant's range of 5-70 °C). Respect to claim 7, Liaw discloses that HF and H<sub>2</sub>SO<sub>4</sub> are used in semiconductor process (read on "semiconductor grade"). Respect to claim 8-9, Liaw teaches to use commercial available HF 49% and H<sub>2</sub>SO<sub>4</sub> 96% (col. 2 lines 49-51).

### ***Response to Arguments***

6. Applicant's arguments filed 12-29-2003 have been fully considered but they are not persuasive.

The Applicants argue that "Gennissen requires the use of IPA in combination with HF in order to etch a sacrificial oxide with a very high selectivity to aluminum. Therefore, if the teachings of Gennissen were to be combined with those of Liaw and Smith, the etchant would necessarily require the use of IPA. However, Applicants do not disclose or claim the use of IPA". The examiner disagrees. This argument is not commensurate with the scope of the claim. There is no limitation in the claim, which excluding the use of IPA. Further, the Applicants use the transitional term "comprising" in claim 1. According to the MPEP 2111.03, the transitional term "comprising" is inclusive or open-ended and does not exclude additional, unrecited elements or method steps.

The Applicants further argue that "Gennissen teach against the use of water in an etching solution where aluminum is present since '*water addition to the HF will result*

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*in rapid attack of the aluminum interconnect due to a higher  $H_3O^+$  concentration'* (see last sentence in conclusion on p. 228)". The examiner strongly disagrees. The Applicants take the conclusion sentence in Gennissen out of context by quoting only a portion of this sentence. The complete sentence is, "The samples should not be rinsed in water, since water addition to the HF will result in rapid attack of the aluminum interconnect due to a higher  $H_3O^+$  concentration". The examiner interprets that the Gennissen teaches that the sample having aluminum material should not be rinsed in water after the etching step. However, Gennissen still teaches the sample with exposed aluminum layer was etched with HF in the presence of water (page 225 col. 2).

The Applicants further argue that Smith discloses rinsing in water, and immersion in water for self-assembly. According to Applicants, "the combination of Gennissen, who teaches against the use of water in the etching solution and for rinsing, and Smith, who require the use of water in the etching solution for rinsing, would result in a nullity". The examiner disagrees. First, as discussed above, the examiner interprets that Gennissen teaches to use water in the etching solution and teaches against the use of water in rinsing solution for the sample having exposed aluminum layer. The examiner further interprets that Smith teaches to use water in both etching and rinsing solution for the sample does not have the aluminum material exposed. Since Gennissen only teaches against the use of water during the rinsing step when aluminum layer is exposed, it would be obvious and logical for excluding water during the rinsing step if the sample has exposed aluminum layer. This combination certainly will not result in a

nullity because Smith does not disclose that aluminum layer was exposed during rinsing step.

***Conclusion***

7. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Binh X Tran whose telephone number is (571) 272-1469. The examiner can normally be reached on Monday-Thursday and every other Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine G Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.



Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Binh X. Tran

NADINE G. NORTON  
SUPERVISOR, PATENT EXAMINER

